

long, chiefly echinating the fibre *in great abundance*; 3, *angulated* equianchorate, about 3-6000ths long, confined to the sarcode. Structure throughout uniformly compact, tough, and firm, without axial condensation. Size of specimen 11 in. high by $2\frac{1}{2}$ in. in diameter in its widest part.

Depth 6 fath.

Obs. This is evidently a *Plumohalichondria* which, in addition to its self-made or proper spicules, has taken in foreign substances for the axial support of its fibre.

P.S.—The general forms of the specimens respectively above given can only be taken *cet. paribus* as characteristic of the species, since the growth of sponges is so frequently more or less influenced in their form by the environment, that unless a great number of specimens of the same species have been seen it is impossible to determine this accurately.

[To be continued.]

XXXIII.—*On an Example of Polymorphism in the Amphipoda.* By CHARLES CHILTON, M.A. (New Zealand).

[Plate X.]

SEVERAL instances of dimorphism in the Crustacea are already known. Fritz Müller, who seems to have been the first to call attention to examples of it in this group, has given two, one in the Isopoda (*Tanais*)* and one in the Amphipoda (*Orchestia*) †; in each of these cases there are two forms of the male to one of the female. Mr. G. M. Thomson has recorded a similar example from the terrestrial *Orchestia* of New Zealand ‡. From the examination of a large number of specimens of *Orchestia* gathered from several different localities in New Zealand he comes to the conclusion that they all belong to one variable species, *Orchestia sylvicola*, the “males of which have at least two forms of the gnathopoda.” Another example is found in *Mæra subcarinata*, Haswell (*M. Petriei*, G. M. Thomson); but here the two forms of the males only differ very slightly from one another. In specimens taken by Mr. Thomson at Stewart Island, New Zealand, the males had “the whole lower surface [of the propodos of the posterior gnathopoda] very densely fringed

* ‘Facts for Darwin,’ p. 20.

† *L. c.* p. 24.

‡ ‘Transactions New-Zealand Institute,’ vol. xiii. p. 212.

with two rows of long simple hairs," and specimens taken by myself in Sydney agree exactly with this description, while those from Lyttelton Harbour differ in that these long simple hairs are entirely absent, and in having the palm more distinctly defined and more uneven, and the dactylos more rounded at the end*.

As Fritz Müller says, "the occurrence of two kinds of males in the same species may perhaps not be a very rare phenomenon in animals in which the males differ widely from the females in structure. But only in those which can be procured in sufficient abundance will it be possible to arrive at the conviction that we have not before us either two different species or animals of different ages"†. In view of this danger I would like to point out that I have not as yet had a sufficient number of specimens of *Mæra subcarinata* to make me feel quite sure that the two forms are not simply animals of different ages. I am the more doubtful in this case because Mr. Walter Faxon has recently shown that what were considered to be dimorphic forms of the male in certain species of *Cambarus* are really "alternating periods in the life of the individual, the 'first form' being assumed during the pairing-season, the 'second form' during the intervals between the pairing-seasons"‡.

In many genera of the Amphipoda, such as *Mæra*, *Melita*, *Paranænia*, *Podocerus*, &c., the females of different species are often much more alike than the corresponding males, which usually have some of their limbs abnormally developed; hence if a supposed case of dimorphism or polymorphism occurs in these genera it is more than usually difficult to decide whether we have several species of which the females are alike, or nearly so, or one species with several forms of the male to one of the female. I have, however, an instance to bring forward from the genus *Microdeuteropus*, and, though I have hesitated for a long time, I think I have now sufficient evidence to show that we have here a widely dispersed species which has three forms of the male and only one of the female.

In 1879 Mr. G. M. Thomson described a species of *Microdeuteropus* from Dunedin Harbour, giving it the name of *M. maculatus*; at the same time he recorded the existence of *Aora typica* in New Zealand, the species having been originally obtained at Valparaiso§. In a subsequent paper he

* 'Transactions New-Zealand Institute,' xv. p. 82; 'New-Zealand Journal of Science,' ii. p. 230; and 'Proceedings Linnean Society N. S. W.' vol. ix. part 4, p. 1039.

† 'Facts for Darwin,' p. 24.

‡ 'American Journal of Science,' vol. xxvii. p. 42.

§ Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 331.

remarked upon the resemblance of *Microdeuteropus maculatus* to *Aora typica* in the following words:—"Though dissimilar in many respects from *Aora typica*, there is such a strong resemblance in other points that I should not be surprised if they prove to be male and female of the same species, in which case the generic character of *Aora* will require modification. Can it be a case of protective resemblance?"*

In 1881 I took numerous specimens of *Microdeuteropus maculatus* in Lyttelton Harbour, and with them a form closely resembling them in all respects except in the first gnathopoda, which were "complexly chelate," like those of *Aora typica*, though differing in some minute details; and in a paper published in the 'Transactions of the New-Zealand Institute,' vol. xiv. p. 173, I suggested that most probably this form rather than *Aora typica* was the male of *Microdeuteropus maculatus*. (In referring to this form I shall speak of it as "*Microdeuteropus maculatus* ♂, Chilton.") Afterwards I took *Aora typica* also in Lyttelton Harbour, and was thus able to see that, though it was really somewhat different from *Microdeuteropus maculatus* ♂, Chilton, as I had previously stated, it was, like that form, essentially similar to *Microdeuteropus maculatus* ♀, Thomson, except in the first gnathopoda. About the same time I heard by letter from Mr. Thomson that he had taken a large number of specimens of *Aora typica* and *Microdeuteropus maculatus* ♀, both at the same locality, and felt convinced that they both belonged to one species. While in Sydney, in January 1884, I obtained specimens of *Microdeuteropus Mortoni*, Haswell, and also of *M. tenuipes*, Haswell. One of my specimens of the latter species was a female bearing eggs, and from the close resemblance of the two I suggested † that *M. Mortoni* was probably the male of *M. tenuipes*. I also remarked upon the very close resemblance between *M. tenuipes* and *M. maculatus* ♀, and between *M. Mortoni*, *M. maculatus* ♂, Chilton, and *Aora typica*, in all points except in the first gnathopoda; but at the time I left the species as distinct, until further evidence should be forthcoming. Since then I have examined the various forms more minutely, and have compared them with Dunedin and Stewart-Island specimens of *M. maculatus* ♀ and *Aora typica*, which were very kindly placed at my disposal by Mr. Thomson, and I now feel convinced that they all belong to one species, of which we therefore now know three forms of the male and one of the female.

The different forms vary somewhat in several small points;

* 'Transactions New-Zealand Institute,' xiii. p. 218.

† 'Proceedings Linnean Society N. S. W.' vol. ix. part 4, p. 1040.

thus the relative lengths of the various joints of the antennæ are subject to slight variations; in large specimens the lower antennæ increase in length as compared with the upper, and the flagellum of the upper antenna decreases in length as compared with the peduncle.

The stout curved setæ on the end of the flagellum of the lower antenna in *Microdeuteropus tenuipes*, mentioned by Mr. Haswell, are present in the other forms; but in many of the specimens they are not very prominent, and they have consequently not been mentioned by other observers.

Mr. Thomson described the appendage to the mandible of *Microdeuteropus maculatus* as two-jointed. In *M. Mortoni*, *M. tenuipes*, in the Lyttelton specimens of *M. maculatus*, both male and female, and of *Aora typica*, it is three-jointed, as is almost universally the case with the Amphipoda, and in the Dunedin specimens of *M. maculatus* and *Aora typica* which I dissected I found it also three-jointed; the first and second joints lie nearly in the same straight line, and though the division between them is distinct enough, they do not appear to be very movable one upon the other; and I fancy this has given rise to the error in Mr. Thomson's description, which is in all other respects exceedingly accurate. In this species, as in many others of the Amphipoda, the cutting-edge of the mandible is not quite the same on the right side as on the left, but the differences in this case are small. On the distal portion of the third joint of the appendage are two rows of long serrated hairs, of which those at the end are the longest and are most closely approximated to one another, and between these are two rows of short straight setæ. It is not very easy to get a good view of these rows in the proper position; when seen in side view they present the appearance of a dense fringe on one side of the joint, as shown in Mr. Thomson's figure*. In his description of *Aora typica* Mr. Thomson says, "telson quite smooth." In all the specimens that I have examined the telson is essentially the same as in *Microdeuteropus maculatus*, viz. the projecting portion on each side is slightly notched at the end and bears one or two slender spinules.

It is curious to note the variations in the parts in which the males and females of different species of the Amphipoda resemble and differ from one another. Thus in some species of *Mæra*, such as *M. subcarinata*, *M. festiva*, and in *Melita tenuicornis*, *Podocerus frequens*, *Podocerus longimanus*, *Paranænia typica*, *Nicea egregia*, &c., the male differs from the female in the structure of the second pair of gnathopoda, while

* Ann. & Mag. Nat. Hist. ser. 5, vol. iv. pl. xvi. fig. 7.

in all these species the *first* pair are the same in the male as in the female. In the forms under consideration exactly the reverse is the case: the male forms differ from the female in the structure of the *first* pair of gnathopoda, while in *Aora typica*, *Microdeuteropus Mortoni*, *M. tenuipes*, *M. maculatus* ♂, and *M. maculatus* ♀, the *second* pair of gnathopoda is essentially the same throughout; and the following description drawn up from Lyttelton specimens of *M. maculatus* ♀ will apply, with the slight variations afterwards mentioned, to the second gnathopoda of all the other forms.

The meros (see Pl. X. fig. 5) is rather pointed distally and has the distal margin supplied with a row of long setæ; the carpus is triangular, the inferior or posterior edge rounded and abundantly supplied with setæ arranged in short transverse rows, the setæ being longest towards the distal end; there is also on the side of the carpus, near its distal end, an oblique row of about six long setæ, and more proximally a much shorter row of from two to three setæ; on the upper or anterior margin are two or three small tufts, the last being situated at the antero-distal angle; the propodos is of the same width as the carpus and has the palm slightly convex, transverse, or but slightly oblique, very minutely serrated, and with a somewhat irregular fringe of rather short setæ, and defined by a stout seta; the posterior edge of the propodos is thickly supplied with setæ arranged in about six short transverse rows or tufts; on the anterior edge are five similar rows, each containing about five setæ, the last one being at the base of the dactylos, and on the side of the dactylos are four or five similar short transverse rows of setæ, arranged in one longitudinal line; the dactylos is fairly stout, inner edge finely serrated, the serrations increasing in size until near the extremity, which is, however, smooth. All the setæ on the posterior margin of the meros, carpus, and propodos appear to be serrated throughout the distal half of their length, and many are slightly bent in the centre, while those on the palm and on the anterior margin of the various joints are simple.

In the specimens of *Microdeuteropus maculatus* ♀ which Mr. Thomson sent me the second gnathopoda agreed very closely with the description given above, but had the palm rather more transverse than in my Lyttelton specimens. *Aora typica*, both Lyttelton and Dunedin specimens of which were examined, also agrees with this description, but has the palm more oblique, and generally has a greater number of setæ than in *Microdeuteropus maculatus* ♀, though they are arranged in precisely the same manner.

The first gnathopod (see Pl. X. fig. 6) of *Microdeuteropus*

maculatus ♀ is somewhat larger than the second, but is of the same general shape; the carpus bears numerous setæ irregularly arranged on the posterior margin; on the anterior margin there is only one tuft at the antero-distal angle; the propodos is supplied with many setæ arranged as in the second gnathopod; the palm is very oblique, slightly curved, and is defined by a stout spine or seta, which is much more prominent than the corresponding one in the second gnathopod. The length of the palm varies considerably; in a tracing of a drawing made by Mr. Thomson, which he has sent me, the palm is represented as occupying almost the whole of the posterior margin of the propodos; in the figure which I give (Pl. X. fig. 6), taken from a female bearing eggs, it is scarcely more than half as long as the propodos; it most probably increases in length with the age of the animal. The dactylos is stout and strongly curved, and is similar to that of the second gnathopod.

In *Aora typica* (see Pl. X. fig. 2) the coxa of the first gnathopod is produced anteriorly into a sharp point, as in *Aora gracilis* *; the basos is long and is produced into a tooth on the anterior margin at a point not far from the base of the joint; there are a few very small setæ at intervals along the anterior margin; at the distal end the integument is produced anteriorly and distally, so as to form a thin plate, which interlaps with a similar but larger plate arising from the ischios. The meros is produced inferiorly into a long acute spine, which is as long or very nearly as long as the carpus; the carpus is longer than the propodos, sides parallel, posterior with a few small tufts of setæ near the distal end; propodos slightly arcuate, with no distinguishable palm in *full-grown specimens*; the distal portion thickly covered with long hairs, arranged in short transverse rows and most numerous at the base of the dactylos. Dactylos slightly curved, of nearly the same width throughout until it narrows suddenly near the end.

In smaller and presumably younger specimens there is a stout seta about the centre of the inferior margin of the propodos, marking off what may be considered a "palm;" this is entirely absent in large specimens (see Pl. X. fig. 3). In these young males the first gnathopod is much more like the first gnathopod of the female than in the full-grown males. I have already described a case similar to this in *Podocerus longimanus* †.

* See Bate and Westwood, 'British Sessile-eyed Crustacea,' figure on p. 281, vol. i.

† 'Transactions New-Zealand Institute,' xvi. p. 256.

The plates into which the integument is produced on the outer sides of the basos and ischios interlap, and appear thus to strengthen the joints, which would otherwise be weak for so long a limb, and they also serve to keep the carpus firmly in its place when that joint is laid back upon the basos, as it usually is when the limb is not being used. The tooth on the anterior margin of the basos seems to be of use for the same purpose. Spence Bate speaks of it as "an apparently useless tooth" *.

In *Microdeuteropus maculatus* ♂, Chilton (see Pl. X. fig. 1), the first gnathopod has the basos long, expanding slightly distally; ischios nearly twice as long as broad, both joints being almost free from setæ; the meros is narrow and is produced inferiorly into a long acute spine reaching beyond the end of the carpus; it is slightly curved towards the extremity and bears on its inferior or posterior margin a small tuft of setæ at about one third of the length of the joint from its extremity; the carpus is very large, more than twice as long as broad, and bears a very few short setæ at the distal end; the propodos is rather more than half the length of the carpus, and is much narrower, and becomes narrower towards the distal end; inferior margin very slightly concave and thickly fringed with setæ more or less regularly arranged in tufts; there is also a tuft on the anterior margin at the base of the dactylos; dactylos more than half as long as the propodos, narrowing regularly towards the extremity, where there are a few short setæ on the inner margin.

In general shape the first gnathopod of *Microdeuteropus Mortoni*, Haswell (see Pl. X. fig. 4), closely resembles that of *M. maculatus* ♂, Chilton, but the setæ are very different, and there are also a few other small differences: the anterior edge of the basos bears a thick fringe of rather long setæ; these setæ are sparsely plumose towards the distal ends; similar setæ are found on the anterior edge of the ischios and on both lateral borders of the meros, which is hollowed out anteriorly to receive the carpus; the setæ on the meros are more or less regularly arranged in tufts, but the acute-pointed end of the joint is naked; ordinary simple setæ are found on the anterior margin of the carpus and on both margins of the propodos; the dactylos is very long, fully as long as the propodos, and bears three or four tufts of setæ on its concave margin.

It is evident from what I have already said that the genera

* 'British Sessile-eyed Crustacea,' i., Introduction, p. li.

Aora and *Microdeuteropus* will have to be combined *; and as *Aora* is the older genus, that name will have to be retained. The specific name *typica* has priority over all the others, so that the name of our species will be *Aora typica*.

I give the synonymy so far as known to me and brief diagnoses of the various forms.

Aora typica.

Aora typica, Kröyer, Tidsskr. ser. 2, p. 328, pl. iii. fig. 3; Spence Bate, Cat. Brit. Mus. Amphip. p. 161, pl. xxix. fig. 3; G. M. Thomson, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 331; Trans. New-Zealand Inst. vol. xiii. p. 216.

Lalaria longitarsis, Nicolet, Gay's Hist. de Chile, iii. pl. ii. fig. 8.

Microdeuteropus Mortonii, Haswell, Proc. Linn. Soc. N. S. W. vol. v. p. 339, pl. xxii. fig. 2; Cat. Australian Crust. p. 264; Chilton, Proc. Linn. Soc. N. S. W. vol. ix. p. 1040.

Microdeuteropus tenuipes, Haswell, l. c. vol. v. p. 339, pl. xxii. fig. 1; Chilton, l. c. vol. ix. p. 1040.

Microdeuteropus maculatus, G. M. Thomson, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 331, figs. 5-8; Trans. N.-Z. Inst. vol. xiii. p. 217, figs. 7 A, B, and C; Chilton, Trans. N.-Z. Inst. vol. xiv. p. 173, fig. 3, a-b.

Female. Animal smooth, slender. Superior antennæ considerably longer than inferior; second joint of peduncle long and slender; third short, and furnished with a 5-6-jointed secondary appendage; flagellum very slender, many-jointed, sparingly ciliated. Inferior antennæ strong, subpediform; third joint of peduncle short, fourth and fifth very long; flagellum shorter than last joint of peduncle, with stout curved setæ in addition to the ordinary slender hairs. Gnathopoda of moderate size, both strongly ciliated; first pair the largest; propodos about as large as the carpus; palm very oblique, almost longitudinal, slightly curved, and defined by a strong spine; dactylos serrated on inner margin; second pair similar, but with palm transverse or but slightly oblique. Fourth and fifth pairs of pleopoda with stout straight spines; sixth pair with two or three spines like those of the preceding pairs, and with a few longer and more slender spines or hairs. Telson raised on each side into an upward projection, each having the apex notched and bearing two or three slender spinules.

Male. Three forms, all differing from the female in the character of the first gnathopod, which in each has the meros produced into a long spine reaching about to the end of the carpus.

* The necessity for this was indeed recognized by the Rev. T. R. R. Stebbing as far back as 1878. See Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 369.

The forms may be distinguished as follows:—

1. (*Aora typica*, Kröyer.)—Basos with a tooth projecting forwards on the anterior margin; carpus longer than the propodos, but of about the same breadth.

2. (*Microdeuteropus maculatus* ♂, Chilton.)—Carpus longer and broader than propodos; meros with small tuft of setæ on posterior margin.

3. (*Microdeuteropus Mortoni*, Haswell.)—Carpus longer and broader than the propodos; meros hollowed anteriorly and with each lateral margin densely fringed with setæ; dactylos as long as propodos and with two or three tufts of setæ on concave border.

EXPLANATION OF PLATE X.

Aora typica.

[All the figures much enlarged.]

Fig. 1. First gnathopod of male, *second form* (*Microdeuteropus maculatus* ♂, Chilton).

Fig. 2. First gnathopod of male, *first form* (*Aora typica*), seen from outer side.

Fig. 3. First gnathopod of an immature specimen of the same form, seen from the inner side.

Fig. 4. First gnathopod of male, *third form* (*Microdeuteropus Mortoni*).

Fig. 5. Second gnathopod of female (*M. maculatus*).

Fig. 6. First gnathopod of female (*M. maculatus*).

XXXIV.—*Notes on Australian Lepidoptera, with Descriptions of new Species.* By RUDOLPH ROSENSTOCK, B.A.

[Plate XI.]

THE following is an account of a small collection of Lepidoptera from South Australia forwarded to the British Museum by Dr. Lucas, of Melbourne.

A number of the specimens were unfortunately in poor condition, being either broken or so much worn as to render identification difficult; and description, in the case of some possibly new species, undesirable. I am nevertheless enabled to describe twenty-eight species, in better condition than those just mentioned, as new to science.

The Microlepidoptera were well represented, as one might expect in collections from this region.

Mr. Meyrick's labours in this division of Lepidoptera afforded me much aid, though I discovered one or two